

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. If $y = (\sin^{-1} x)^2$, show that $(1 - x^2)y_{n+2} - (2n+1)xy_{n+1} - n^2y_n = 0$ find $(y_n)_0$.
17. Solve $(D^2 + 3D + 2)y = e^{2x} + x^2 + \sin x$.
18. Form the partial differential equation by eliminating the arbitrary function in $z = xt_1(x+t) + t_2(x+t)$.
19. Evaluate $\iint_S \vec{F} \cdot \hat{n} ds$, where $\vec{F} = 18z\vec{i} - 12\vec{j} + 3y\vec{k}$ as S is the part of the plane $2x + 3y + 6z = 12$ which is in the first octant.
20. Obtain the Fourier Series expression for $f(x) = e^x$ in the interval $-\pi < x < \pi$.

NOVEMBER/DECEMBER 2025

23UEEL22 — BASIC MATHEMATICS – II

Time : Three hours

Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. If $y = e^{ax} \sin bx$ prove that $y_2 - 2ay_1 + (a^2 + b^2)y = 0$.
2. Write the Leibnitz's theorem for the n^{th} derivative of the product of two functions.
3. Solve $(D^2 - 4D + 3)y = 0$.
4. Solve $(D^2 - 3D + 2)y = 2$.
5. Form the partial differential equation by eliminating the arbitrary constant from $z = (x^2 + a)(y^2 + b)$.
6. From the partial differential equation by eliminating arbitrary function from $z = f(xy)$.



7. Find $\nabla\phi$ if $\phi = xyz$ at $(1, 1, 1)$.
8. Show that $\vec{F} = yz\vec{i} + zx\vec{j} + xy\vec{k}$ is irrotational.
9. Evaluate $\int xe^{an} \cdot dn$.
10. Write the formula, Fourier series for a function in $(-\pi, \pi)$.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) If $u = r \cos \theta$, $v = r \sin \theta$, find $\frac{\partial(x,y)}{\partial(r,\theta)}$ and $\frac{\partial(r,\theta)}{\partial(x,y)}$.

Or

- (b) Find the n^{th} derivative of $\frac{x}{(x-1)(2x+3)}$.

12. (a) Solve $(D^2 - D - 2)y = e^{2x} + e^x$.

Or

- (b) Solve $(D^2 + D - 2)y = \sin 2x$.

13. (a) Form the partial differential equations by eliminating a, b, c from $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$.

Or

- (b) Eliminate the arbitrary function in $xyz = \phi(x^2 + y^2 - z^2)$.

- (a) If $\vec{F} = x^2\vec{i} + xy\vec{j}$, evaluate $\int \vec{F} \cdot d\vec{r}$ from $(0, 0)$ to $(1, 1)$ along the line $y = x$.

Or

- (b) If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ prove that $\nabla r = \frac{\vec{r}}{r}$, where $r = |\vec{r}|$.

15. (a) Find the Fourier series of the function $f(x) = x^2$ in $(-\pi, \pi)$.

Or

- (b) Find the Fourier series of the function $f(x) = \begin{cases} -K, & -\pi < x < 0 \\ K, & 0 < x < \pi \end{cases}$